What is claimed is:

1. A system for an automotive vehicle having a wheel comprising:

a first roll condition detector generating a first roll condition signal;

a second roll condition detector generating a second roll condition signal;

a third roll condition detector generating a third roll condition signal; and

determining wheel lift in response to the first roll condition, the second roll condition and the third roll condition.

2. A system as recited in claim 1 wherein first roll condition, said second roll condition and said third roll condition are determined passively.

3. A system as recited in claim 1 wherein said controller generates a passive wheel lift status signal.

4. A system as recited in claim 1 wherein said passive wheel lift status signal comprises a plurality of levels.

5. A system as recited in claim 1 wherein said controller generates a potential rollover signal in response to the wheel lift signal.

6. A system as recited in claim 5 further comprising a safety device, said controller controlling said safety device in response to said potential rollover signal.

7. A system as recited in claim 6 wherein said safety comprises at least one of an active brake control system, an active rear steering system, an active front steering system, an active anti-roll bar system, and an active suspension system.

8. A method for controlling an automotive vehicle having an axle and wheels comprising:

determining a first roll condition;

determining a second roll condition;

determining a third roll condition; and

generating a wheel lift status signal in response to the first roll condition, the second roll condition and the third roll condition.

9. A method as recited in claim 8 wherein determining the first roll condition comprises:

measuring a roll rate; measuring a vehicle lateral acceleration; and

determining a relative roll angle in response to the vehicle roll rate and the vehicle lateral acceleration.

10. A method as recited in claim 9 further comprising determining a wheel departure angle in response to the vehicle roll rate and the vehicle lateral acceleration.

11. A method as recited in claim 8 wherein determining a second roll condition comprises determining a rolling radius-based wheel departure roll angle.

12. A method as recited in claim 8 wherein determining a third roll condition comprises determining a normal loading at each wheel.

13. A method as recited in claim 8 further comprising determining a fourth roll condition and wherein determining a wheel lift comprises determining a wheel lift in response to the first roll condition, the second roll condition, the third roll condition and the fourth roll condition.

14. A method as recited in claim 8 wherein determining a fourth roll condition comprises calculating an actual road torque.

15. A method as recited in claim 8 further comprising determining a fifth roll condition and wherein determining a wheel lift comprises determining a wheel lift in response to the first roll condition, the second roll condition, the third roll condition, the fourth roll condition and the fifth roll condition.

16. A method as recited in claim 15 wherein determining comprises determining a fifth roll condition comprises determining a wheel longitudinal slip.

17. A method of controlling a vehicle having a plurality of wheels comprising:

determining a relative roll angle;

determining a wheel departure angle;

determining a rolling radius-based wheel departure angle;

determining normal loading at each wheel;

determining an actual road torque;

determining a wheel longitudinal slip; and

determining a wheel lift status for said plurality of wheels in response to said relative roll angle, said wheel departure angle, said rolling radius-based wheel departure roll angle, the normal loading at each wheel, an actual road torque and the wheel longitudinal slip.

18. A method as recited in claim 17 wherein determining a relative roll angle comprises measuring a roll rate;

measuring a vehicle lateral acceleration; and

determining the relative roll angle in response to a vehicle roll rate and the vehicle lateral acceleration.

19. A method as recited in claim 17 wherein determining a wheel departure angle comprises:

measuring a roll rate;

measuring a vehicle lateral acceleration; and

determining the wheel departure angle in response to a vehicle roll rate and the vehicle lateral acceleration.

20. A method as recited in claim 17 wherein determining a rolling radius-based wheel departure angle comprises:

measuring a wheel speed;

determining a wheel linear velocity; and

determining the rolling radius-based wheel departure angle in response to the wheel speed and the wheel linear velocity.

21. A method as recited in claim 17 wherein determining normal loading at each wheel comprises determining a heave and non-heave load at each of the plurality of wheels.

22. A method as recited in claim 17 wherein determining an actual road torque comprises determining a driving torque, determining a braking torque and determining a wheel rotation inertia.

23. A method as recited in claim 17 wherein determining a wheel longitudinal slip comprises determining a slip power and a slip rate, and wherein determining a wheel lift status comprise determining a wheel lift status for said plurality of wheels in response to said relative roll angle, said wheel departure angle, said rolling radius-based wheel departure roll angle, the normal loading at each wheel, an actual road torque, the wheel longitudinal slip, said slip power and said slip rate.

24. A method for controlling an automotive vehicle having a plurality of wheels comprising:

determining a first wheel lift condition;

determining a second wheel lift condition;

determining a third wheel lift condition; and

generating a wheel lift flag in response to the first wheel lift condition, the second wheel lift condition and the third wheel lift condition.

25. A method as recited in claim 24 wherein generating a wheel lift flag comprises generating a wheel lift flag for each of the plurality of wheels.

26. A method as recited in claim 24 further comprising comparing the first wheel lift condition to a first threshold;

comparing the second wheel lift condition to a second threshold;

comparing the third wheel lift condition to a third threshold;

wherein generating a wheel lift flag comprises generating a wheel lift flag is performed in response to comparing the first wheel lift condition to a first threshold, comparing the second wheel lift condition to a second threshold, and comparing the third wheel lift condition to a third threshold.

27. A method of controlling an automotive vehicle having a first wheel and a second wheel having a common axis comprising:

determining a first wheel speed;

determining a first linear corner velocity of

the wheel;

determining a first rolling radius of the wheel as a function of the wheel speed and linear corner velocity; and

controlling a safety system in response to the first rolling radii.

28. A method as recited in claim 27 further comprising:

determining a longitudinal slip ratio;

comparing the slip ratio to a slip ratio threshold; and

performing determining a first rolling radius when the longitudinal slip ratio is below the slip ratio threshold.

29. A method as recited in claim 27 wherein determining a linear corner velocity comprises determining a linear corner velocity as a function of a side slip angle and a vehicle reference velocity.

30. A method as recited in claim 27 wherein determining a linear corner velocity comprises determining a linear corner velocity as a function of a steering wheel angle and a vehicle reference velocity.

31. A method as recited in claim 27 wherein determining a linear corner velocity comprises determining a linear corner velocity as a function of a side slip angle, steering wheel angle, and a vehicle reference velocity.

32. A method as recited in claim 27 further comprising determining a second rolling radii corresponding to the second wheel.

33. A method as recited in claim 32 further comprising determining a wheel departure angle as a function of the first rolling radii and the second rolling radii.

34. A method of controlling an automotive vehicle having a first wheel, a second wheel comprising:

determining a wheel speed;

determining a vehicle speed;

determining a linear corner velocity of the wheel as a function of the vehicle speed;

determining a first rolling radius of the first wheel as a function of the wheel speed and the linear corner velocity;

determining a rolling radius wheel departure angle as a function of the first rolling radius;

generating a wheel lift signal in response to the rolling radius departure angle; and

controlling a safety system in response to the wheel lift signal.

35. A method for passively determining wheel lift of a wheel of an automotive vehicle comprising:

determining a wheel speed;

determining a linear corner velocity of the wheel;

determining a rolling radius of the wheel as a function of the wheel speed and linear corner velocity;

determining a rolling radius wheel departure angle as a function of the rolling radius; and

determining a wheel lift condition as a function of the operating input torque, the rotational speed of the wheel and the wheel response.

36. A method for controlling an automotive vehicle comprising:

determining a slip power for a wheel;

determining convergence or divergence of the slip power;

generating a wheel lift signal in response to divergence of the slip power; and

controlling a safety system in response to the wheel lift signal.

37. A method as recited in claim 36 further comprising generating a wheel grounded signal in response to convergence of the slip power.

38. A method as recited in claim 36 wherein the slip power is a function of a slip ratio.

39. A method as recited in claim 38 wherein determining a slip ratio is determined as a function of wheel speed and the vehicle velocity.

40. A method as recited in claim 39 wherein determining a slip ratio is determined as a function of wheel speed, yaw rate and the vehicle velocity.

41. A method of controlling an automotive vehicle comprising:

determining a slip ratio;

determining a slip power in response to the slip ratio;

when the slip power is positive, generating a wheel lift signal; and

controlling a safety system in response to the wheel lift signal.

42. A method as recited in claim 41 further comprising when the slip power is negative, generating a wheel grounded signal.

43. A method as recited in claim 41 further comprising controlling a safety system in response to the wheel grounded signal.

44. A method as recited in claim 41 wherein determining a slip power comprises determining the slip power in response to the slip ratio and a time derivative of the slip ratio.

45. A method as recited in claim 41 wherein determining a slip ratio is determined as a function of wheel speed and the vehicle velocity.

46. A method as recited in claim 41 wherein determining a slip ratio is determined as a function of wheel speed, yaw rate and the vehicle velocity.

47. A system for an automotive vehicle having a safety system comprising:

a plurality of wheel speed sensor generating a plurality of wheel speed signals including a first wheel speed signal;

a vehicle velocity generator generating a vehicle velocity signal; and

a controller coupled to said wheel speed sensor and the vehicle velocity generator, said controller determining a slip ratio in response to the wheel speed signal and the vehicle velocity signal, said controller determining a slip power in response to the slip ratio, when the slip power is positive, said controller generating a wheel lift signal and said controller controlling the safety system in response to the wheel lift signal.

48. A system as recited in claim 47 wherein the plurality of wheel speed signals are used to generate the vehicle velocity signal.

49. A system as recited in claim 47 further comprising a yaw rate sensor generating a yaw rate signal, said slip ratio being a function of the yaw rate signal.

50. A method for controlling an automotive vehicle comprising:

determining a slip rate for a wheel;

comparing the slip rate to a threshold;

generating a wheel lift signal in response to slip rate when the slip rate is above a threshold; and

controlling a safety system in response to the

wheel lift signal.

51. A method as recited in claim 50 further comprising generating a wheel grounded signal in response to slip rate.

52. A method as recited in claim 50 wherein the slip rate is a function of a slip ratio.

53. A method as recited in claim 52 wherein determining a slip ratio is determined as a function of wheel speed and the vehicle velocity.

54. A method as recited in claim 52 wherein the slip rate is a function of the time derivative of the slip ratio.

55. A method as recited in claim 52 wherein determining a slip ratio is determined as a function of wheel speed, yaw rate and the vehicle velocity.

56. A method of controlling automotive vehicle comprising:

determining a slip rate;

generating a wheel lift signal in response to slip rate; and

controlling a safety system in response to the wheel lift signal.

57. A method as recited in claim 56 further comprising generating a wheel grounded signal in response to slip rate.

58. A method as recited in claim 57 further comprising controlling a safety system in response to the wheel grounded signal.

59. A method as recited in claim 56 wherein determining a slip rate comprises determining the slip rate in response to a velocity and a time derivative of a slip ratio.

60. A method as recited in claim 59 wherein determining a slip ratio is determined as a function of wheel speed and the vehicle velocity.

61. A method as recited in claim 59 wherein determining a slip ratio is determined as a function of wheel speed, yaw rate and the vehicle velocity.

62. A system for an automotive vehicle having a safety system comprising:

a plurality of wheel speed sensor generating a plurality of wheel speed signals including a first wheel speed signal;

a vehicle velocity generator generating a vehicle velocity signal; and

a controller coupled to said wheel speed sensor and the vehicle velocity generator, said controller determining a slip ratio in response to the wheel speed signal and the vehicle velocity signal, said

controller determining a slip rate in response to the slip ratio, when the slip rate is above a threshold, said controller generating a wheel lift signal and said controller controlling the safety system in response to the wheel lift signal.

63. A system as recited in claim 62 wherein the plurality of wheel speed signals are used to generate the vehicle velocity signal.

64. A system as recited in claim 62 wherein the plurality of wheel speed signals are used to generate a corner velocity signal, wherein the slip rate is a function of the corner velocity signal

65. A system as recited in claim 63 further comprising a yaw rate sensor generating a yaw rate signal, said slip ratio being a function of the yaw rate signal.

66. A method of controlling an automotive vehicle comprising:

determining a heave normal load and a non-heave normal load;

determining a total normal load as a function of the heave normal load and non-heave normal load;

generating a wheel lift signal in response to the total normal load; and

controlling a safety system of an automotive vehicle in response to the wheel lift signal.

67. A method as recited in claim 66 wherein the heave normal load is a function of a vertical acceleration.

68. A method as recited in claim 66 wherein the heave normal load is a function of a roll angle.

69. A method as recited in claim 68 wherein the roll angle is a relative roll angle.

70. A method as recited in claim 68 wherein the roll angle is a function of roll rate.

71. A method as recited in claim 66 wherein the heave normal load is a function of a vertical acceleration and a relative roll angle.

72. A method as recited in claim 66 wherein the heave normal load is a function of pitch angle.

73. A method as recited in claim 72 wherein the pitch angle is a relative pitch angle.

74. A method as recited in claim 72 wherein the pitch angle is a function of a pitch rate.

75. A method as recited in claim 66 wherein the heave normal load is a function of a vertical acceleration, relative roll angle and pitch angle and a vehicle mass.

76. A method as recited in claim 66 wherein the non-heave normal load is a function of a vertical acceleration.

77. A method as recited in claim 66 wherein the non-heave normal load is a function of roll angle.

78. A method as recited in claim 77 wherein the roll angle is a relative roll angle.

79. A method as recited in claim 77 wherein the roll angle is a function of roll rate.

80. A method as recited in claim 66 wherein the non-heave normal load is a function of a vertical acceleration and relative roll angle.

81. A method as recited in claim 66 wherein the non-heave normal load is a function of pitch angle.

82. A method as recited in claim 81 wherein the pitch angle is a relative pitch angle.

83. A method as recited in claim 81 wherein the pitch angle is a function of a pitch rate.

84. A method as recited in claim 66 wherein the non-heave normal load is a function of a vertical acceleration, relative roll angle and pitch angle and a spring rate of the vehicle mass.

85. A method of controlling a vehicle having a wheel and suspension comprising:

determining a pitch angle;

determining a roll angle;

determining a vertical acceleration;

determining a normal loading due to a heave motion in response to pitch angle, roll angle, vertical acceleration and a mass of the vehicle;

determining a normal loading due to non-heave motion in response to pitch angle, roll angle, vertical acceleration and a spring rate of the suspension;

determining a total normal load as a function of the normal loading due to the heave motion and a normal load due to non-heave motion;

generating a wheel lift signal in response to the total normal load; and

controlling a safety system of an automotive vehicle in response to the wheel lift signal.

86. A method as recited in claim 85 wherein the roll angle is a relative roll angle.

87. A method as recited in claim 85 wherein the roll angle is a function of roll rate.

88. A method as recited in claim 85 wherein the pitch angle is a relative pitch angle.

89. A method as recited in claim 85 wherein the pitch angle is a function of a pitch rate.

90. A system for controlling an automotive vehicle having a wheel, a suspension and a safety system comprising:

a pitch rate sensor generating a pitch rate signal;

a vertical acceleration sensor;

a roll rate sensor generating a roll rate signal; and

a controller coupled to the vertical acceleration sensor, the roll rate sensor and the pitch rate sensor, said controller determining a roll angle from the roll rate signal and a pitch angle from the pitch angle signal, said controller determining normal loading due to a heave motion in response to pitch angle, roll angle, vertical acceleration and a mass of the vehicle, said controller determining a normal loading due to non-heave motion in response to pitch angle, roll angle, vertical acceleration and a spring rate of the suspension, said controller determining a total normal load as a function of the normal loading due to the heave motion and a normal load due to non-heave motion, said controller generating a wheel lift signal in response to the total normal load, and said controller controlling the safety system of an automotive vehicle in response to the wheel lift signal.

91. A system as recited in claim 90 wherein the roll angle is a relative roll angle.

92. A system as recited in claim 90 wherein the pitch angle is a relative pitch angle.

93. A method of controlling an automotive vehicle having a wheel comprising:

determining an actual road torque applied to the wheel;

determining a calculated road torque; and

generating a wheel lift signal in response to the calculated road torque and the actual road torque.

94. A method as recited in claim 93 wherein determining an actual road torque comprises determining an actual road torque as a function of wheel acceleration.

95. A method as recited in claim 93 wherein determining an actual road torque comprises determining an actual road torque as a function of wheel acceleration and driving torque.

96. A method as recited in claim 93 wherein determining an actual road torque comprises determining an actual road torque as a function of wheel acceleration and braking torque.

97. A method as recited in claim 93 wherein determining an actual road torque comprises determining an actual road torque as a function of wheel acceleration, driving torque and braking torque.

98. A method as recited in claim 93 wherein determining a calculated road torque comprises determining a calculated road torque in response to normal loading.

99. A method as recited in claim 93 wherein determining a calculated road torque in response to normal loading comprises determining a heave normal load and a non-heave normal load, and determining a total normal load as a function of the heave normal load and non-heave normal load.

100. A method as recited in claim 93 wherein determining a calculated road torque comprises determining a calculated road torque in response to normal loading and longitudinal wheel slip.

101. A method of controlling an automotive vehicle comprising:

determining a braking torque;

determining a driving torque;

determining a wheel acceleration;

determining an actual road torque as a function of wheel acceleration, driving torque and braking torque;

determining a total normal load;

determining a calculated road torque in response to the total normal load;

comparing the actual road torque and the calculated road torque;

when the actual road torque is less than the calculated road torque, generating a wheel lift signal; and

controlling a safety device in response to the wheel lift signal.

102. A method as recited in claim 101 wherein determining a total normal load comprises determining a heave normal load and a non-heave normal load, and determining a total normal load as a function of the heave normal load and non-heave normal load.

103. A method as recited in claim 101 wherein determining a total normal load as a function of the heave normal load and non-heave normal load comprises determining a heave load in response to pitch angle, roll angle, vertical acceleration and a mass of the vehicle.

104. A method as recited in claim 101 wherein determining a total normal load as a function of the heave normal load and non-heave normal load comprises determining a non-heave load as a function of pitch angle, roll angle, vertical acceleration and a spring rate of a suspension

105. A method as recited in claim 101 wherein determining a calculated road torque comprises determining a calculated road torque in response to normal loading a longitudinal wheel slip.

106. A method for controlling an automotive vehicle having a plurality of wheels comprising:

measuring a yaw rate;

determining a lateral acceleration;

determining a roll rate;

determining longitudinal acceleration;

generating wheel lift signal as a function of

yaw rate, lateral acceleration, roll rate and longitudinal acceleration; and

controlling a safety system in response to the wheel lift signal.

107. A method as recited in claim 106 further comprising determining a pitch acceleration and, wherein determining wheel lift comprises determining wheel lift as a function of yaw rate, lateral acceleration, roll rate, longitudinal acceleration and pitch acceleration.

108. A method as recited in claim 106 further comprising controlling the safety system to counteract wheel lift.